

1

3,411,534

## FOUR-WAY VALVE

Frank L. Rose, Cleveland Heights, Ohio, assignor to  
Tracor, Inc., Austin, Tex., a corporation of Texas

Filed Dec. 28, 1966, Ser. No. 605,350

8 Claims. (Cl. 137-595)

### ABSTRACT OF THE DISCLOSURE

A four-way valve having two flexible tubes mounted in a housing, a cam element mounted for rotation in said housing and said cam having operative portions for selective pinching contact with either one, none, or both of said tubes to control fluid flow.

This invention relates to a 4-way valve for use with a couple of generally parallel flexible tubes. Specifically, the invention relates to a valve which is capable of simple and reliable operation to leave both of said tubes open, close both of said tubes, or selectively leave either one of said tubes open while closing the other tube.

In many applications where a couple of flexible tubes in generally parallel orientation are employed, as the double drain tubes used for medical purposes, it is often desired to shut off flow in one or the other of the tubes, while continuing flow in the other tube. Further, it is sometimes desirable to shut off flow in both tubes, and it is sometimes desirable to allow fluid flow through both tubes simultaneously. In the past, it has been customary to employ clamps on each tube individually, the flow through each of the tubes being controlled by operation of the respective clamp. With this system, it is difficult to close or open each tube at the same instant, if that is desired, and at any rate this cannot be done with one hand. No matter how the operations are carried out, it is often cumbersome to maintain and employ separate controls for the two lines.

The present invention provides a valve which is useful in those instances where a pair of generally parallel flexible tubes are employed for the transfer of fluids, and provides in this context a valve which is capable of leaving both tubes open, closing both tubes, or selectively closing one or the other of the tubes. In order that the invention may be clearly understood in greater detail, reference is made to the embodiments of the invention illustrated in the accompanying drawings, which form a part of this specification and wherein:

FIGURE 1 is a pictorial view of an instrument constructed in accordance with one embodiment of this invention, in use with a couple of generally parallel flexible tubes;

FIGURE 2 is a horizontal cross-sectional view taken through the instrument illustrated in FIGURE 1, illustrating the valve in a first position wherein both tubes are closed;

FIGURE 3 is a view similar to FIGURE 2, illustrating the valve in a second position, wherein one tube is closed;

FIGURE 4 is a cross-sectional view, taken along the line 4-4 of FIGURE 3;

FIGURE 5 is a view similar to FIGURES 2 and 3, illustrating the valve member in a third position, wherein both tubes are open;

FIGURE 6 is a view similar to FIGURES 2-3 and 5, illustrating the valve member in a fourth position, wherein one tube is open;

FIGURE 7 is a view similar to FIGURES 2-3 and 5-6, illustrating the valve member in a fifth position, wherein both tubes are closed;

FIGURE 8 is a plan view of an alternative form of cam element for the valve of this invention;

2

FIGURE 9 is a plan view of another form of cam element for the valve of this invention;

FIGURE 10 is a plan view of still another form of cam element for the valve of this invention;

FIGURE 11 is a plan view of still another form of cam element for the valve of this invention; and

FIGURE 12 is a plan view of still another form of cam element for the valve of this invention.

Referring now in more detail to the drawings, a 4-way valve 1 in accordance with the invention is illustrated in FIGURE 1. The instrument 1 comprises a housing 5 which may be of any suitable configuration but which in this embodiment is a 6-sided generally solid case. The case may be made of any suitable material such as a synthetic polymeric material. Longitudinally through the housing 5 extend a couple of generally cylindrical passageways 6, through which are adapted to be placed a couple of flexible tubes 2 and 3, such as double drain tubes. At least in the central part of the housing 5, the cylindrical openings are longitudinally parallel-extending.

As seen in FIGURES 2-7, a generally cylindrical bore or recess 10 is formed in the housing 5, preferably centrally disposed therein. The passageways 6 are arranged with relation to the recess 10 in a manner such that the outer wall of each such opening is approximately tangential with the recess 10, the tangent for one of the tubes being 180° from the tangent for the other tube. The tubes 2 and 3 are thus placed in the opening so that they are generally parallel therethrough.

In the recess 10 is disposed a valve member 7, which comprises generally a knob 23 which extends above the upper surface of the housing so that the valve member may be easily turned by the user. Operably connected with knob portion 23, and integral in this embodiment, is a cam element 11 which extends into the portion of the recess 10 occupied by the tubes 2 and 3.

The shape of the cam element 11 is in some features critical. In each of the illustrated embodiments, it will be seen that the cam element has a major side and a minor side. The major side includes, in each instance, at least three points on the arc of a circle. More specifically, the major side includes two points on the chord of a circle, one at the intersection of the chord with the circle on one side, and the other at the intersection of the chord with the circle on the other side. A third point on the arc is located at the intersection of the perpendicular bisector of the chord with the circle. The minor side includes at least one point on the circle, substantially 180° from the above-mentioned third point. In the illustrated embodiments, this point on the minor side is located at the intersection of the other end of the perpendicular bisector with the circle.

In the embodiments shown in FIGURES 8-12, the first and second points described above are labeled "a" and "b," and the third point on the major side is labeled "c." The above-mentioned point on the minor side is labeled "d" in each of these embodiments.

The corresponding points on the chord in the FIGURES 2-7 embodiment are 14 and 15; the third point on the major side is 13, and the point on the minor side is 12.

In the FIGURES 2-7 embodiment, the cam 11 is seen to be comprised generally of a major or pie-shaped portion 24 and a minor or radial portion 25, from a common center 26. The valve member 7 is placed in position in the recess 10 so that the center 26 of the cam is in the center of the circle formed by the cross-section of the cylindrical recess 10. The peripheral surface of pie-shaped section 24 terminates at ends 14 and 15, and this surface is arcuate and adapted to fit just inside the bore formed by the recess 10. The straight portion 25 of cam 11 extends radially from the point 26, 180° disposed from a mid-point 13 of pie-shaped portion 24, equidistant from the